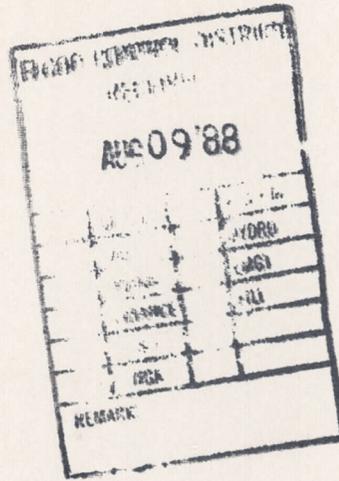


SPEEDIE AND ASSOCIATES

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REPORT ON SOIL INVESTIGATION

DESIGNATION: 67th Avenue Storm Drain
LOCATION: 67th Ave. & Greenway Rd.
Glendale, Arizona
CLIENT: Greiner Engineering
PROJECT NO: 880190SA
DATE: August 1, 1988



A118.902

SPEEDIE AND ASSOCIATES

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JAMES A. SPEEDIE, P.E.
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STEVEN A. GRIESS, P.E.

REPORT ON SOIL INVESTIGATION

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INTRODUCTION

This report presents the results of a subsoil investigation carried out along the route of the proposed 67th Avenue Storm Drain. The storm drain will extend from Bell road south to Greenway Road along 67th Avenue. In addition, a segment will extend west along Greenway road, terminating at the Arizona Central ^{Canal} Diversionary ^{Channel} Canal (A.C.D.C.).

GENERAL ROUTE AND SOIL CONDITIONS

Route Conditions - The alignment of the proposed storm drains are within the right-of-ways of 67th Avenue and Greenway Road and slightly offset from centerline. The roadways are paved with asphaltic concrete.

Surrounding land is generally residential and commercial with some open undeveloped areas.

General Subsurface Conditions - Subsoil conditions along the route are somewhat variable. The street is paved with 2.0 to 4.0 inches of asphalt overlaying 3.5 to 10.0 inches of aggregate base. In Test Borings 2, 5 and 6, +2.0 feet of very stiff brown sandy clay/sandy silt fill was encountered. Native soils consist of very stiff to hard, light brown to brown clay and sandy clay to a depth of 7.0 to 8.0 feet. Moisture contents range from 13 to 17 percent, and plastic limits range from 21 to 33 percent. In-place dry densities are on the order of 94.8 to 115.7 PCF. Swell tests indicate that the more clayey upper soils exhibit a moderate potential for volume increase due to wetting when compacted to moistures and densities expected during construction.

This stratum exhibits a Standard Penetration Resistance (SPT) of 15 to 50-plus blows per foot.

The more clayey upper soils are underlain by dense to very dense red-brown gravelly sand with occasional cobbles and subordinate hard light brown clay throughout the depths investigated. Moisture contents are on the order of 7.1 percent. These strata exhibit a Standard Penetration Resistance of 39 to 50-plus blows per foot.

All borings were dry upon completion. The Arizona Department of Water Resources reports groundwater to be approximately 800 feet deep in this area. Therefore, groundwater should not be a factor in the design and construction of the storm sewer.

ANALYSIS AND RECOMMENDATIONS

Analysis - Trenching in the coarse grained material encountered along much of the route may become difficult and the excavation will require bracing to maintain an open trench and protect workmen. The deeper trenches will produce oversize material not suitable for pipe bedding.

The finer grained soils should result in trouble-free trenching and, bore and jack operations. In these areas, excavations should result in relatively neat trenches. In all cases where trenches are deeper than shoulder height, bracing will be required to protect workmen.

In order to provide uniform support, we recommend that the pipe be supported on a minimum of 6.0 inches of ABC bedding. This bedding should extend up to the springline of the pipe to ensure proper backfill in tight trench situations. Bedding material, backfill and compaction should meet MAG Section 601 Specifications. Cobbles and other oversize materials should not be used as backfill within 2.0 feet of the pipe. A shrinkage value of approximately 10 percent can be expected for the sandy to clayey native soils.

Soil Corrosion - The results of resistivity tests at the Test Boring sites are presented in Figure No. 9. Values range from 5,746 to 11,492 ohm-cm which indicate a low potential for corrosion.

GENERAL

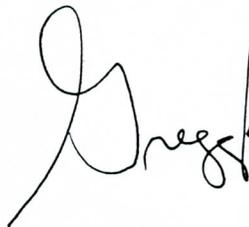
The scope of this investigation and report does not include regional considerations such as seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, nor any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

Respectfully submitted,



Stephen J. Smelser, Geologist



Gregg A. Creaser, P.E.

August 1, 1988

APPENDIX

FIELD AND LABORATORY INVESTIGATION Page 1 of 1

SOIL BORING LOCATION PLAN Plate 1

SOIL LOG LEGEND Plate 2

LOG OF TEST BORING: Boring No. B-1 Figure No. 1
 Boring No. B-2 Figure No. 2
 Boring No. B-3 Figure No. 3
 Boring No. B-4 Figure No. 4
 Boring No. B-5 Figure No. 5
 Boring No. B-6 Figure No. 6

TABULATION OF TEST DATA Figure No. 7

SWELL TEST DATA Figure No. 8

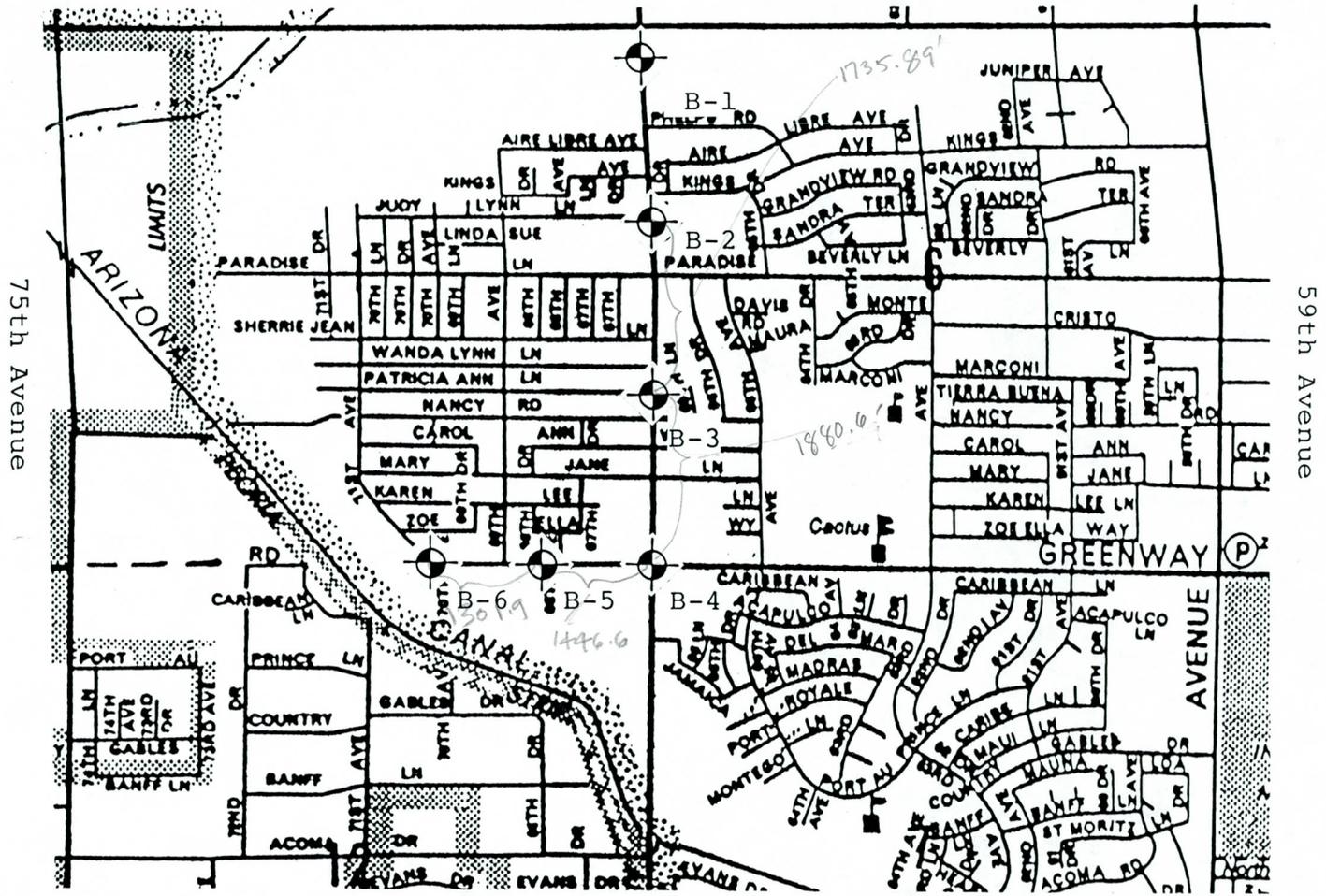
RESISTIVITY TEST DATA Figure No. 9

FIELD AND LABORATORY INVESTIGATION

On July 18, 1988, six soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan, Plate 1. All exploration work was carried out under the full-time supervision of our engineer, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced with a truck-mounted Mobile B-56 drill rig utilizing 7.0 inch diameter hollow stem flight augers. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution and plasticity (Atterberg Limits) tests for classification and pavement design parameters. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. All field and laboratory data is presented in this Appendix as Figures No. 1 through 9.

Bell Road



75th Avenue

59th Avenue

67TH AVENUE STORM DRAIN
 67TH AVE. & GREENWAY RD.
 GLENDALE, ARIZONA

**SPEEDIE
 AND ASSOCIATES**
 GEOTECHNICAL AND SITE ENGINEERS
 PROJECT NO. 880190SA

PLATE 1

SOILS CLASSIFICATION CHART

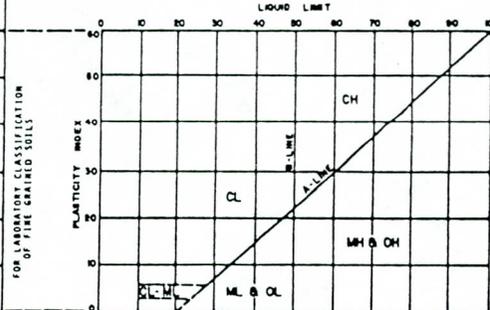
MAJOR DIVISIONS		GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION REMAINED ON NO. 4 SIEVE	GRAVEL WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	
		SC	CLAYEY SANDS, SAND-CLAY MIXTURES	
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	MH	INORGANIC SILTS, MUCOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

GRADATION CHART

MATERIAL SIZE	PARTICLE SIZE				
	LOWER LIMIT		UPPER LIMIT		
	MILLIMETERS	SIET SIZE*	MILLIMETERS	SIET SIZE*	
SAND	FINE	0.75	#200*	0.425	#40*
	MEDIUM	0.425	#40*	0.250	#60*
	COARSE	0.250	#60*	0.150	#100*
GRAVEL	FINE	4.75	#40*	1.91	3/4"*
	COARSE	1.91	3/4"*	0.75	3"*
COBBLES		76.2	3"	304.8	12"
BOULDERS		304.8	12"	914.4	36"

*U.S. Standard *Clear Square Openings

PLASTICITY CHART



CONSISTENCY			RELATIVE DENSITY	
CLAYS & SILTS	BLOWS/FOOT*	STRENGTH †	SANDS & GRAVELS	BLOWS/FOOT*
VERY SOFT	0-2	0-X	VERY LOOSE	0-4
SOFT	2-4	X-X	LOOSE	4-10
FIRM	4-8	X-1	MEDIUM DENSE	10-30
STIFF	8-16	1-2	DENSE	30-50
VERY STIFF	16-32	2-4	VERY DENSE	OVER 50
HARD	OVER 32	OVER 4		

* Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).

† Unconfined compressive strength in tons/sq ft. Read from a pocket penetrometer.

SAMPLE DESIGNATION	PENETRATION RESISTANCE SYMBOL	DESCRIPTION
Bag	-	Large Bulk Sample
BS	-	Misc. Grab Sample - Bottle or Bag
AS	-	Auger Sample - A grab sample taken directly from auger flights
S	●	Spoon Sample - Standard Penetration Test (ASTM D-1586)-Driving a 2.0-inch outside diameter, 1 3/8-inch inside diameter, split spoon sampler into undisturbed soil for three successive 6-inch increments of penetration by means of a 140-pound weight falling freely through a distance of 30 inches. The cumulative number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).
LS	●	Liner Sample - Standard Penetration Test-Driving a 2.0-inch outside diameter split spoon, equipped with two, 3-inch long by 1 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil as above.
RS	○	Ring Sample - Driving a 3.0-inch outside diameter spoon, equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by means of a 140-pound weight falling freely through a distance of 30 inches. The blows required for the 12 inches of penetration are recorded.
ST	-	Shelby Tube - A 3.0-inch outside diameter thin-walled tube continuously pushed into undisturbed soil by a rapid motion, without impact or twisting. (ASTM D-1587)
-	■	Continuous Penetration Resistance (Bullnose) - Driving a 2.0-inch outside diameter "Bullnose penetrometer" continuously into undisturbed soil by means of a 140-pound weight falling freely through a distance of 30 inches. The blows for each successive 12-inch increment are recorded.

NOTE: The stratification lines shown on the Logs of Test Borings and/or Test Pit represent the approximate boundary between soil types, and the transition may be gradual.

SOIL LOG
LEGEND

SPEEDIE & ASSOCIATES
GEOTECHNICAL AND SITE ENGINEERS
1100 NORTH 24TH AVENUE SUITE 800
PHOENIX, ARIZONA 85016

ELEVATION (FEET)

GROUND SURFACE ELEVATION: <u>N/A</u>		* SOIL DESCRIPTION				SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT
	3.0" Asphaltic Concrete On 4.0" ABC	0.6'								
	Very Stiff Light Brown And White Mottled CLAY (CL - Dry).	3.5'	RS-1	2.0	16.9	100.6				
			BS-2	3.0	-	-				
	Very Stiff Light Brown And White Mottled SANDY CLAY (CL - Dry) With A Trace Of Gravel.	8.5'	S-3	5.5	-	-				
	Dense Red-Brown CLAYEY GRAVELLY SAND (SP - Dry).	12.0'	S-4	10.5	-	-				
	Very Dense Red-Brown SAND (SC - Dry) With A Trace Of Clay.	15.5'	S-5	15.5	-	-			15/12" →	
	Very Dense Brown GRAVELLY SAND (SP - Dry).	19.8'	S-6	19.8	-	-			94/10" →	
	END OF BORING									

* Sample Depth

BORING STARTED: 07-18-88
 BORING COMPLETED: 07-18-88
 FIELD ENGINEER/TECHNICIAN: S. J. Smelser
 DRILLER: R. Wilder
 CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry
 NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES	
LOG OF TEST BORING NUMBER <u>B-1</u>	
67TH AVENUE STORM DRAIN 67TH AVENUE & GREENWAY ROAD GLENDALE, ARIZONA	
APPROVED: <i>[Signature]</i>	DATE: 08-02-88
PROJECT NO: 880190SA	FIGURE NO: 1

ELEVATION (FEET)

GROUND SURFACE ELEVATION: <u>N/A</u>		*				
SOIL DESCRIPTION		SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT
	2.5" Asphaltic Concrete On 10.0" ABC. 1.0'					
	Fill - Very Stiff Brown CLAY (CL - Moist) With A Trace Of Sand. 3.0'	S-1	2.5	-	-	
	Hard Light Brown GRAVELLY SILT (ML - Dry) With A Trace Of Sand And Weak Cementation. 7.0'	RS-2	4.9	14.1	94.8	50/10" →
	Very Dense Red-Brown GRAVELLY SAND (SP - Dry) With A Trace Of Clay And Occasional Cobbles. 14.0'	S-3	10.5	-	-	65/12" →
	Hard Brown SANDY CLAY (CL - Dry). 18.0'	S-4	15.3	-	-	97/10" →
	Very Dense Red-Brown GRAVELLY SAND (SP - Dry) With Occasional Cobbles. 19.9'	S-5	19.9	-	-	63/11" →
	CONTINUED ON NEXT SHEET					
	* Sample Depth					

BORING STARTED: 07-18-88
 BORING COMPLETED: 07-18-88
 FIELD ENGINEER/TECHNICIAN: S. J. Smelser
 DRILLER: R. Wilder
 CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry
 NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES	
LOG OF TEST BORING NUMBER <u>B-2</u>	
67TH AVENUE STORM DRAIN 67TH AVENUE & GREENWAY ROAD GLENDALE, ARIZONA	
APPROVED: <i>JK</i>	DATE: 08-02-88
PROJECT NO: 880190SA	FIGURE NO: 2

ELEVATION (FEET)

GROUND SURFACE ELEVATION: <u>N/A</u>		* STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT				
SOIL DESCRIPTION		SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	
	Very Dense Red-Brown GRAVELLY SAND (SP - Dry) With Occasional Cobbles. 22.0'					
	Very Dense Red-Brown CLAYEY SAND With Some Gravel. 28.0'	S-6	25.4	-	-	94/11" →
	Hard Brown CLAY (CL - Dry) With A Trace Of Sand. 30.4'	S-7	30.4	-	-	87/11" →
	END OF BORING					

* Sample Depth

BORING STARTED: 07-18-88
 BORING COMPLETED: 07-18-88
 FIELD ENGINEER/TECHNICIAN: S. J. Smelser
 DRILLER: R. Wilder
 CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry
 NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES	
LOG OF TEST BORING NUMBER B-2	
67TH AVENUE STORM DRAIN 67TH AVENUE & GREENWAY ROAD GLENDALE, ARIZONA	
APPROVED: <i>gk</i>	DATE: 08-02-88
PROJECT NO: 880190SA	FIGURE NO: 2

*

GROUND SURFACE ELEVATION: N/A
 SOIL DESCRIPTION

SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT
---------------	-------------------------	---------------------------	-------------------------------	------------------------------------------------

3.0" Asphaltic Concrete On 10.0" ABC	1.1'
Very Stiff Brown CLAY (CL - Moist) With A Trace Of Sand.	3.5'
Very Stiff Light Brown And White Mottled CLAY (CL - Dry) With A Trace Of Sand And Gravel.	8.0'
Very Dense Red-Brown GRAVELLY SAND (SP - SM - Dry) With A Trace Of Silt.	18.0'
Hard Light Brown CLAY (CL - Dry) With A Trace Of Sand And Gravel.	20.4'

S-1	2.5	-	-	
S-2	5.5	-	-	
S-3	10.5	-	-	63/12" →
S-4	14.9	-	-	90/11" →
S-5	20.4	-	-	85/11" →

ELEVATION (FEET)

END OF BORING
 * Sample Depth

BORING STARTED: 07-18-88
 BORING COMPLETED: 07-18-88
 FIELD ENGINEER/TECHNICIAN: S. J. Smelser
 DRILLER: R. Wilder
 CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry
 NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES	
LOG OF TEST BORING NUMBER <u>B-3</u>	
67TH AVENUE STORM DRAIN 67TH AVENUE & GREENWAY ROAD GLENDALE, ARIZONA	
APPROVED: 	DATE: 08-02-88
PROJECT NO: 880190SA	FIGURE NO: 3

ELEVATION (FEET)

GROUND SURFACE ELEVATION: <u>N/A</u>		* SOIL DESCRIPTION				SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT
2.0" Asphaltic Concrete On 4.0" ABC.		0.5'				RS-1	2.0	9.3	115.7	
Medium Dense Brown CLAYEY SAND (SC - Dry) With A Trace Of Gravel.		3.5'				S-2	5.5	-	-	
Very Stiff Light Brown And White Mottled CLAY (CL - Dry) With A Trace Of Sand And Gravel.		7.0'				S-3	10.5	-	-	
Very Dense Red-Brown CLAYEY GRAVELLY SAND (SP - Dry).		11.5'				S-4	14.3	-	-	
Very Dense Red-Brown GRAVELLY SAND (SP - Dry) With Weak Cementation.		15.5'				S-5	19.9	-	-	
Very Dense Red-Brown GRAVELLY SAND (SP - Dry) With Occasional Cobbles.		19.9'								
CONTINUED ON NEXT SHEET										

* Sample Depth

BORING STARTED: 07-18-88
 BORING COMPLETED: 07-18-88
 FIELD ENGINEER/TECHNICIAN: S. J. Smelser
 DRILLER: R. Wilder
 CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry

NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES

LOG OF TEST BORING NUMBER B-4

67TH AVENUE STORM DRAIN
 67TH AVENUE & GREENWAY ROAD
 GLENDALE, ARIZONA

APPROVED:

DATE: 08-02-88

PROJECT NO: 880190SA

FIGURE NO: 4A

*

GROUND SURFACE ELEVATION: <u>N/A</u>		SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT
SOIL DESCRIPTION						
Very Dense Red-Brown GRAVELLY SAND (SP - Dry) With Occasional Cobbles.	29.4'	S-6	24.2	-	-	50/2" →
	END OF BORING	S-7	29.4	-	-	50/5" →

ELEVATION (FEET)

* Sample Depth

BORING STARTED: 07-18-88
 BORING COMPLETED: 07-18-88
 FIELD ENGINEER/TECHNICIAN: S. J. Smelser
 DRILLER: R. Wilder
 CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry
 NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES	
LOG OF TEST BORING NUMBER <u>B-4</u>	
67TH AVENUE STORM DRAIN 67TH AVENUE & GREENWAY ROAD GLENDALE, ARIZONA	
APPROVED: <i>AK</i>	DATE: 08-02-88
PROJECT NO: 880190SA	FIGURE NO: 4B

*

GROUND SURFACE ELEVATION: <u>N/A</u>	
SOIL DESCRIPTION	
2.5" Asphaltic Concrete On 4.0" ABC.	0.5'
Fill - Very Stiff Brown SANDY CLAY (CL - Moist) With A Trace Of Gravel.	2.5'
Very Stiff Light Brown And White Mottled CLAY (CL - Dry) With A Trace Of Sand And Gravel.	8.0'
Dense Red-Brown GRAVELLY SAND (SP - SM - Dry) With A Trace Of Silt.	12.0'
Very Dense Red-Brown GRAVELLY SAND (SP - Dry).	20.5'
END OF BORING	
* Sample Depth	

SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT
S-1	2.5	-	-	
S-2	5.5	-	-	
S-3	10.5	7.1	-	
S-4	15.4	-	-	90/11" →
S-5	20.5	-	-	71/12" →

ELEVATION (FEET)

BORING STARTED: 07-18-88
 BORING COMPLETED: 07-18-88
 FIELD ENGINEER/TECHNICIAN: S. J. Smelser
 DRILLER: R. Wilder
 CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry
 NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES	
LOG OF TEST BORING NUMBER <u>B-5</u>	
67TH AVENUE STORM DRAIN 67TH AVENUE & GREENWAY ROAD GLENDALE, ARIZONA	
APPROVED: <i>[Signature]</i>	DATE: 08-02-88
PROJECT NO: 880190SA	FIGURE NO: 5

*

GROUND SURFACE ELEVATION: N/A
 SOIL DESCRIPTION

SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT
---------------	-------------------------	---------------------------	-------------------------------	------------------------------------------------

Very Dense Red-Brown GRAVELLY SAND (SP - Dry) With Occasional Cobbles.

S-7	25.0	-	-	87/12" →
-----	------	---	---	----------

_____ 29.5' _____
 END OF BORING

S-8	29.5	-	-	50/6" →
-----	------	---	---	---------

ELEVATION (FEET)

* Sample Depth

BORING STARTED: 07-18-88
 BORING COMPLETED: 07-18-88
 FIELD ENGINEER/TECHNICIAN: S. J. Smelser
 DRILLER: R. wilder
 CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry

NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES	
LOG OF TEST BORING NUMBER B-6	
67TH AVENUE STORM DRAIN 67TH AVENUE & GREENWAY ROAD GLENDALE, ARIZONA	
APPROVED: 	DATE: 08-02-88
PROJECT NO: 880190SA	FIGURE NO: 6B

TABULATION OF TEST DATA

TEST BORING OR TEST PIT NUMBER	SAMPLE NUMBER	DEPTH OF SAMPLE TIP	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (PERCENT OF DRY WEIGHT)	IN-PLACE DRY DENSITY (POUNDS PER CUBIC FOOT)	PARTICLE SIZE DISTRIBUTION PERCENT FINER					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	#3 IN. SIEVE	LIQUID LIMIT (PERCENT)	PLASTIC LIMIT (PERCENT)	PLASTICITY INDEX (PERCENT)	
B-1	RS-1	2.0	-	16.9	100.6	72	88	96	99	100	37	21	16	CL
B-1	BS-2	3.0	-	-	-	-	-	-	-	-	43	22	21	CL
B-2	RS-2	5.0	-	14.1	94.8	52	63	72	84	100	40	27	13	ML
B-3	S-3	10.5	-	-	-	8	20	38	51	100	← NP	→	SP-SM	
B-4	RS-1	2.0	-	9.3	115.7	48	71	93	99	100	33	18	15	SC
B-5	S-3	10.5	-	7.1	-	10	20	37	50	100	← NP	→	SP-SM	
B-6	RS-1	2.0	-	12.9	101.8	-	-	-	-	-	-	-	-	ML
B-6	BS-2	3.0	-	-	-	-	-	-	-	-	47	33	14	ML
B-6	RS-3	5.0	-	13.7	100.8	-	-	-	-	-	-	-	-	CL

PROJECT NO. 880190SA

SPEEDIE
AND ASSOCIATES

SHEET 1 OF 1

SWELL TEST DATA

BORING/ PIT NO.	SAMPLE DEPTH (FT.)	REMOLDED DRY DENSITY (PCF)	INITIAL MOISTURE CONTENT PERCENT	PERCENT COMPACTION	INITIAL DEGREE OF SATURATION PERCENT	FINAL DEGREE OF SATURATION PERCENT	TOTAL SWELL PERCENT
B-1/BS-2	3.0	106.4	17.5	95.8	83.7	99.9	0.2*
B-1/BS-2	3.0	106.5	13.8	96.0	66.0	103.1	0.6*
B-6/BS-2	3.0	106.4	15.6	96.6	74.4	96.1	3.1**
B-6/BS-2	3.0	106.3	12.2	96.5	58.3	96.1	6.1**

* - Based on a maximum dry density of 111.0 PCF at 16.2 percent moisture.
 ** - Based on a maximum dry density of 110.1 PCF at 15.0 percent moisture.

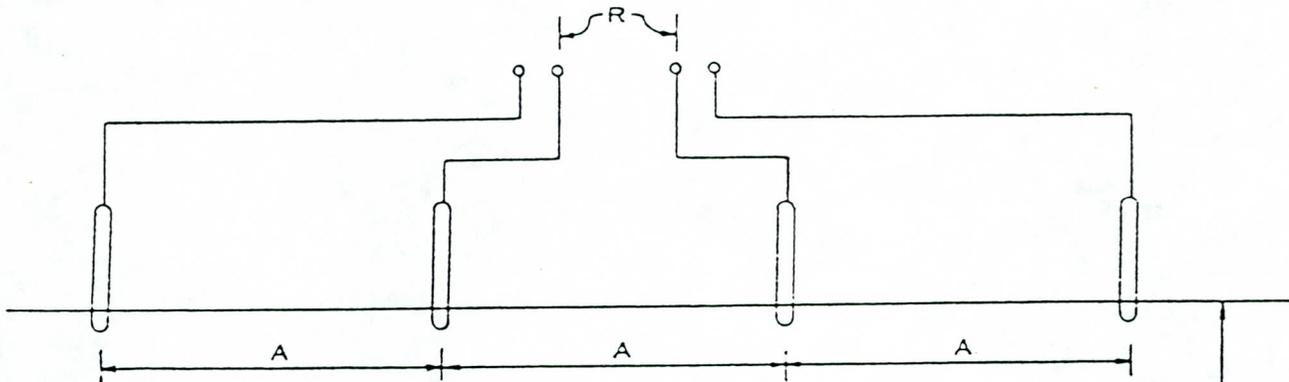
FIGURE NO. 8

67TH AVENUE STORM DRAIN
 67TH AVE. & GREENWAY RD.
 GLENDALE, ARIZONA

**SPEEDIE
 AND ASSOCIATES**
 GEOTECHNICAL AND SITE ENGINEERS
 PROJECT NO. 880190SA

SOIL RESISTIVITY DETERMINATION

PROJECT 67th Avenue Storm Drain
 LOCATION 67th Avenue & Greenway Road - Glendale, Arizona
 INSPECTOR SJS DATE 7-18-88 CHK. BY SJS DATE 7-19-88



$P = 2\pi AKR$

WHERE: P = AVERAGE SOIL RESISTIVITY TO DEPTH OF 'A'
(OHM-CENTIMETERS)

A = DISTANCE BETWEEN ELECTRODES (FEET)

R = MEGGER INSTRUMENT READING (OHMS)

K = 30.48 CM/FT

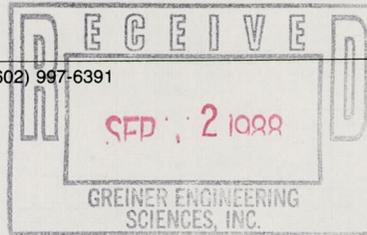
<u>TEST NUMBER</u>	<u>A (FEET)</u>	<u>R (OHMS)</u>	<u>P (OHM-CM)</u>
B-1	15.0'	2.5	7182.6
B-2	15.0'	3.0	8619.1
B-3	15.0'	3.0	8619.1
B-4	15.0'	2.5	7182.6
B-5	15.0'	2.0	5746.1
B-6	15.0'	4.0	11492.2

REMARKS: _____

SPEEDIE AND ASSOCIATES

GEOTECHNICAL AND SITE ENGINEERS

11029 N. 24th AVE., SUITE 805 • PHOENIX, ARIZONA 85029 • (602) 997-6391



JAMES A. SPEEDIE, P.E.
GREGG A. CREASER, P.E.
GARY E. STOCKER, P.E.
STEVEN A. GRIESS, P.E.

August 29, 1988
Project No. 880190SA

Mr. Mustafa Chudnoff
Greiner, Inc.
7310 N. 16th Street
Phoenix, Arizona 85020

RE: Addendum No. 1
67th Avenue Storm Sewer
Glendale, Arizona

FLOOD CONTROL DISTRICT RECEIVED	
SEP 14 1988	
CH ENG	P & PM
REP	HYDRO
ADMIN	LMGT
PERMITS	FILE
SAO	
ENGR	
REMARKS	

Dear Mr. Chudnoff:

At your request we have performed one additional Soil Test Boring for the proposed 67th Avenue Storm Sewer at a point 800 feet south of the Greenway Road centerline on 67th Avenue (see Soil Boring Location Plan, Plate 1).

Subsoil conditions encountered are similar to those encountered in the original investigation. The street is paved with 4.0 inches of asphalt overlaying 32.0 inches of ABC and select. The underlying native soil consists of stiff brown and white mottled clay to a depth of 7.5 feet. This stratum exhibits a Standard Penetration Resistance (SPT) of 6 blows per foot.

The more clayey upper soils are underlain by 12.0 feet of medium dense to very dense light-brown to reddish-brown silty sand and gravelly sand. This stratum exhibits a Standard Penetration Resistance of 21 to 50-plus blows per foot. Auger refusal was met on very dense sand, gravel, and cobble material at a depth of 21.0 feet.

The soil test boring was dry upon completion. The Arizona Department of Water Resources reports groundwater to be approximately 800 feet deep in this area. Therefore, groundwater should not be a factor in the design and construction of the storm sewer.

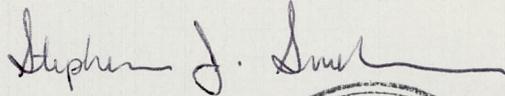
The recommendations set forth in our original report should be followed as no significant changes were encountered.

Mr. Mustafa Chudnoff
Greiner, Inc.
August 29, 1988

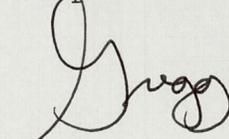
In addition, station numbers and offsets have been assigned to the previous soil test borings along 67th Avenue and are included in this addendum. If you have any questions, please contact our office.

Respectfully submitted,

SPEEDIE & ASSOCIATES



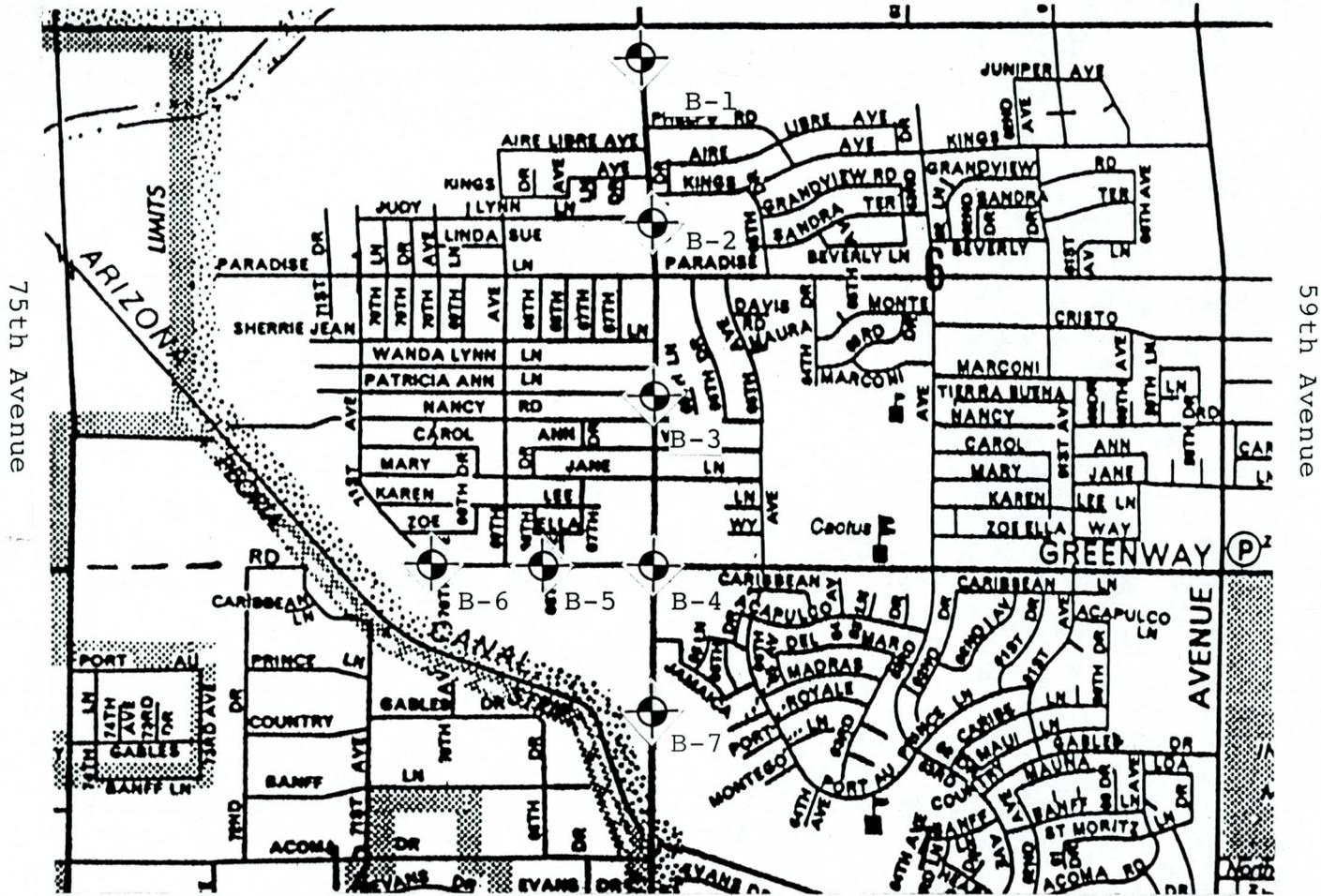
Stephen J. Smelser, Geologist



Gregg A. Creaser

GAC:fm
Attachments

Bell Road



75th Avenue

59th Avenue

PLATE 1



Soil Boring Location

67TH AVENUE STORM DRAIN
67TH AVE. & GREENWAY RD.
GLENDALE, ARIZONA

**SPEEDIE
AND ASSOCIATES**
GEOTECHNICAL AND SITE ENGINEERS

PROJECT NO. 880190SA

GROUND SURFACE ELEVATION: <u>N/A</u> SOIL DESCRIPTION		*				STANDARD PENETRATION NUMBER (N) BLOWS PER FOOT		
		SAMPLE NUMBER	ELEVATION OF SAMPLE TIP	NATURAL WATER CONTENT (%)	IN-PLACE DRY DENSITY (P.C.F.)	0	25	50
ELEVATION (FEET)	4.0 Inches Asphaltic Concrete On 32.0 Inches ABC And Select. 3.0'							
	Firm Brown And White Mottled CLAY (CL - Moist). 7.5'	S-1	5.5	-	-			
	Medium Dense Light Brown SILTY SAND (SM - Dry) With A Trace Of Clay. 11.5'	S-2	10.5	-	-			
	Dense Reddish-Brown GRAVELLY SAND (SW - Dry). 16.0'	S-3	15.5	-	-			
	Very Dense Reddish-Brown GRAVELLY SAND (SW - Moist) With A Trace Of Clay And Occasional Cobbles. 19.8'	S-4	19.8	-	-	79/10"		
CONTINUED ON NEXT SHEDT * Sample Depth								

BORING STARTED: 08-25-88
BORING COMPLETED: 08-25-88
FIELD ENGINEER/TECHNICIAN: S. Smelser
DRILLER: D. Ulses
CONTRACTOR: Heber Mining

≡ WATER LEVEL IN HOLE AT Dry

NUMBERS OF HOURS AFTER COMPLETION:

SPEEDIE AND ASSOCIATES	
LOG OF TEST BORING NUMBER <u>B-7</u>	
67TH AVENUE STORM DRAIN 67TH AVENUE & GREENWAY ROAD GLENDALE, ARIZONA	
APPROVED: <u>SSS</u>	DATE: 08-29-88
PROJECT NO: 880190SA	FIGURE NO: 1A

STATION NUMBERS AND OFFSETS
67TH AVENUE SOIL TEST BORINGS

<u>Boring</u>	<u>Station</u>	<u>Offset</u>
B-1	Sta. 59+00	Centerline
B-2	Sta. 46+00	20' West of Centerline
B-3	Sta. 33+00	5' West of Centerline
B-4	Sta. 20+00	20' West of Centerline
B-7	Sta. 12+00	15' West of Centerline

FIGURE NO. 3